HEADQUARTERS

QUARTERMASTER RESEARCH & ENGINEERING COMMAND

U S ARMY



TECHNICAL REPORT

EP-110



# ATLAS OF MEAN DAILY MINIMUM TEMPERATURES



QUARTERMASTER RESEARCH & ENGINEERING CENTER
ENVIRONMENTAL PROTECTION RESEARCH DIVISION

MAY 1959

NATICK, MASSACHUSETTS

HEADQUARTERS
QUARTERMASTER RESEARCH & ENGINEERING COMMAND, US ARMY
OFFICE OF THE COMMANDING GENERAL
NATICK, MASSACHUSETTS

Major General Andrew T. McNamara
The Quartermaster General
Washington 25, D. C.

Dear General McNamara:

The inclosed report, "Atlas of Mean Daily Minimum Temperatures," shows the worldwide variation, by seasons, of a climatic element that is a useful criterion of the degree of cold stress to be expected in a given area. The maps in this atlas have a direct application to Quartermaster Corps problems in determining clothing allowance zones and areas of issue for other items designed to meet specified temperature minima. It is expected that the maps will serve as a useful reference in environmental research, and will be a valuable tool for improving the present regionalization of the world for issue of Quartermaster items.

Sincerely yours,

C. G. CALLOWAY
Major General, USA
Commanding

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EP-110

HEADQUARTERS
QUARTERMASTER RESEARCH & ENGINEERING COMMAND, US ARMY
Quartermaster Research & Engineering Center
Natick, Massachusetts

ENVIRONMENTAL PROTECTION RESEARCH DIVISION

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# ATLAS OF MEAN DAILY MINIMUM TEMPERATURES

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REGIONAL ENVIRONMENTS RESEARCH BRANCH

Project Reference:
7-83-01-005

May 1959

## FOREWORD

Since World War II, Army clothing and protective equipment have been issued according to a zonation of the world based mainly on mean monthly temperatures. The inadequacies of such a zonation prompted the Quartermaster Corps to consider other methods of regionalizing the world according to the degree of cold stress to be expected. A simple but more realistic measure is provided by mean daily minimum temperatures, which are the basis of current attempts to improve the delimitation of regions within which issue of given items of clothing and equipment is authorized.

Although mean daily minimum temperature data are available for stations throughout the inhabited parts of the world, adequate maps showing the distribution of this climatic element by months have not heretofore been available. To meet this need for such maps, a contract was negotiated with Clark University to map isotherms showing mean daily minimum temperatures, by months, for each continent except Antarctica. In order to make more widely available the maps of this series representing seasonal conditions, those for January, April, July, and October are published in this atlas. The maps prepared by Clark University have been modified in some cases as additional data have become available.

AUSTIN HENSCHEL, Ph.D.
Chief
Environmental Protection
Research Division

Approved:

CARL L. WHITNEY, Lt Col, QMC
Commanding Officer
QM R and E Center Laboratories

J. FRED OESTERLING, Ph.D.
Acting Scientific Director
QM Research & Engineering Command

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## ABSTRACT

Isotherms of mean daily minimum temperature at intervals of 5° F Fahrenheit degrees (5 ~~Centigrade degrees~~) are shown for January, April, July, and October, on 24 maps representing each continent except Antarctica. Isotherms are based upon data from land stations only.


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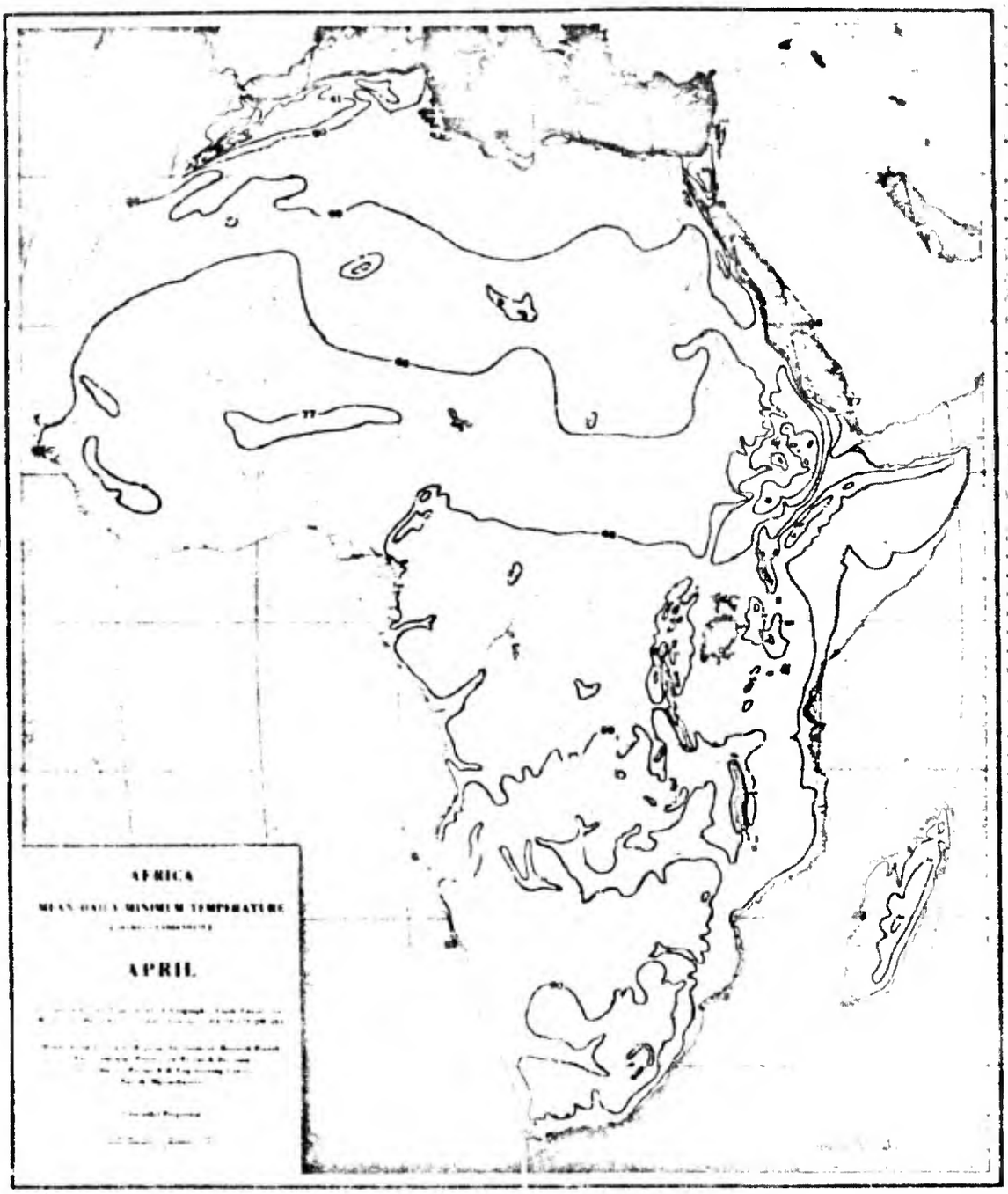
JANUARY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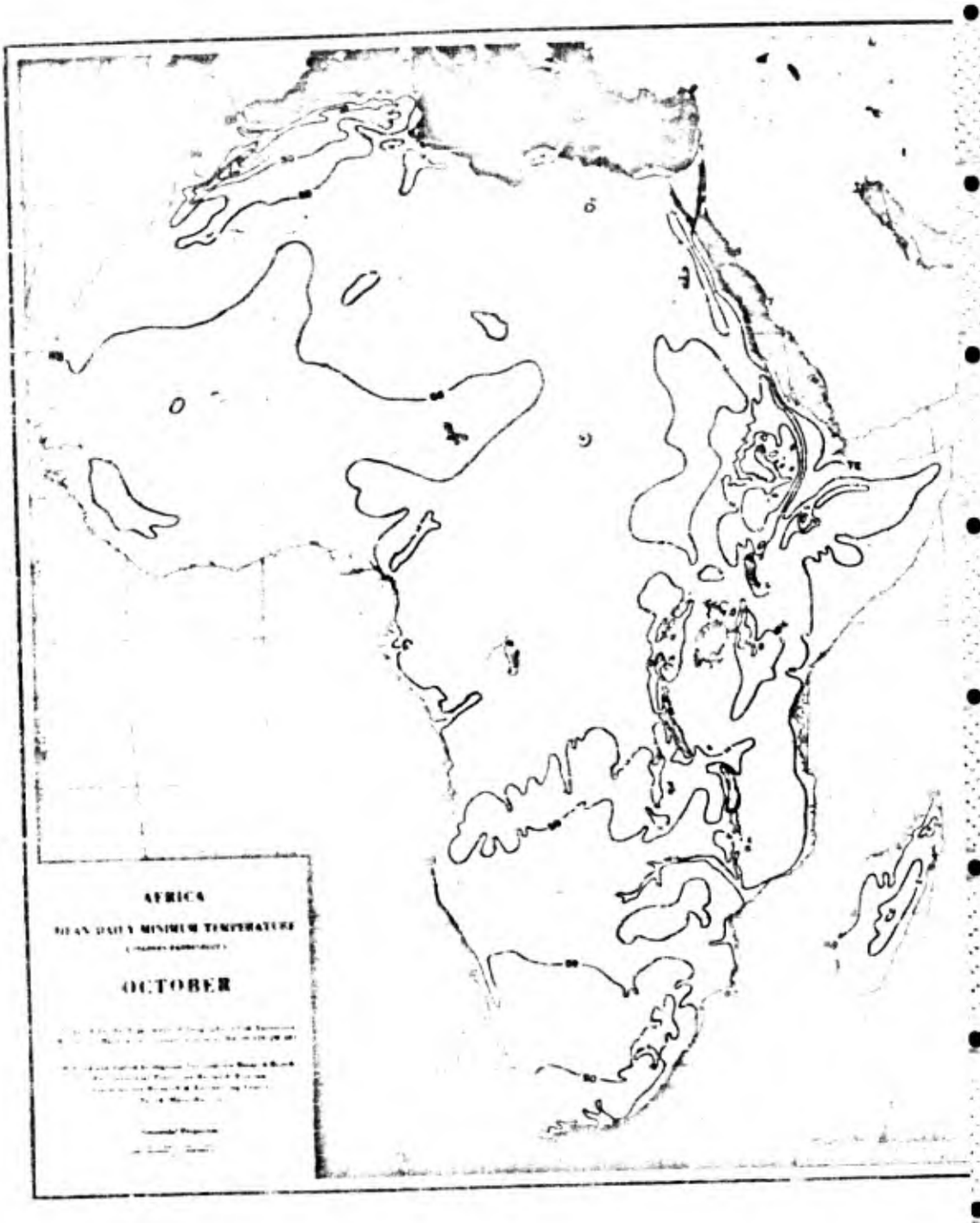
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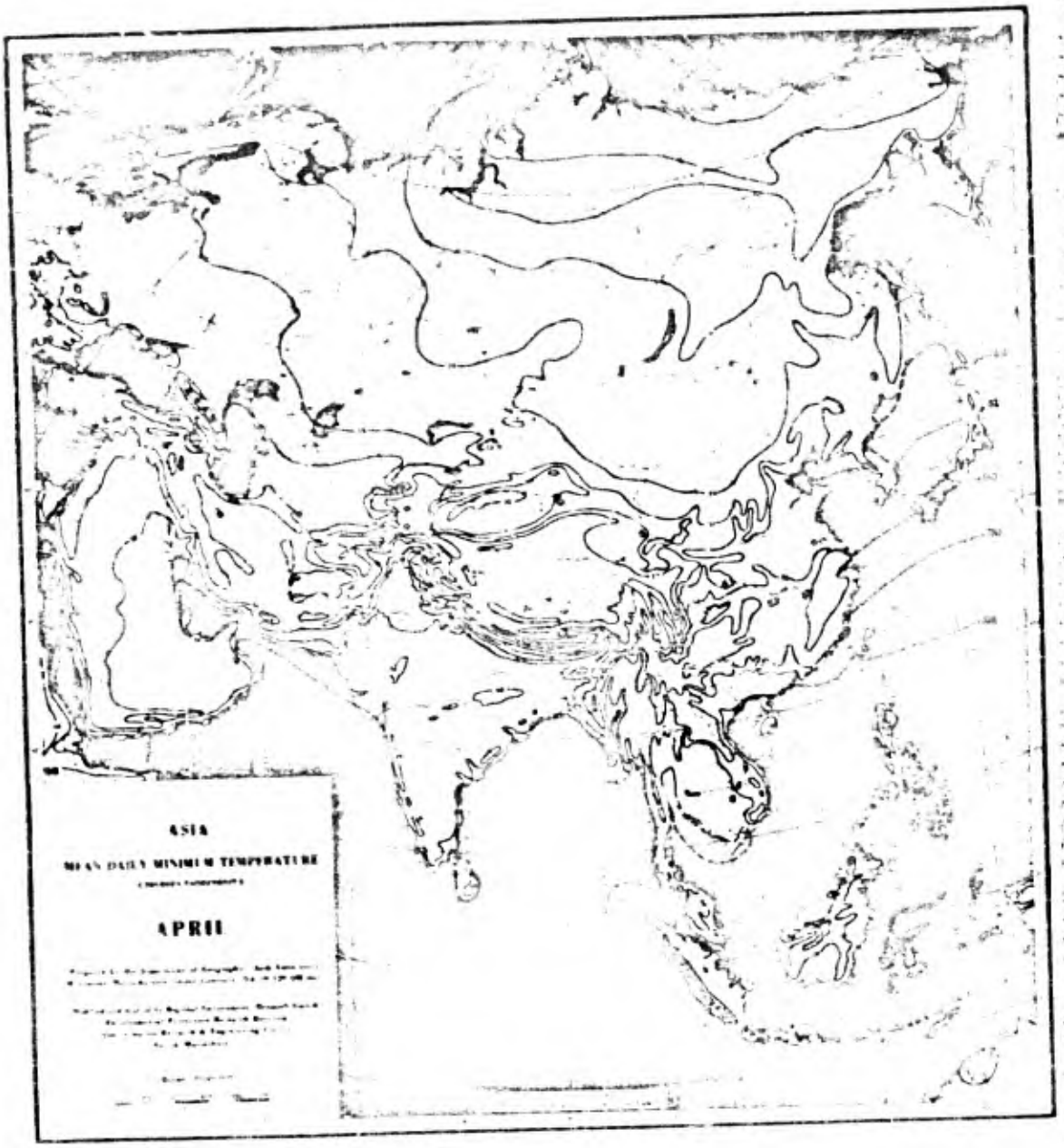
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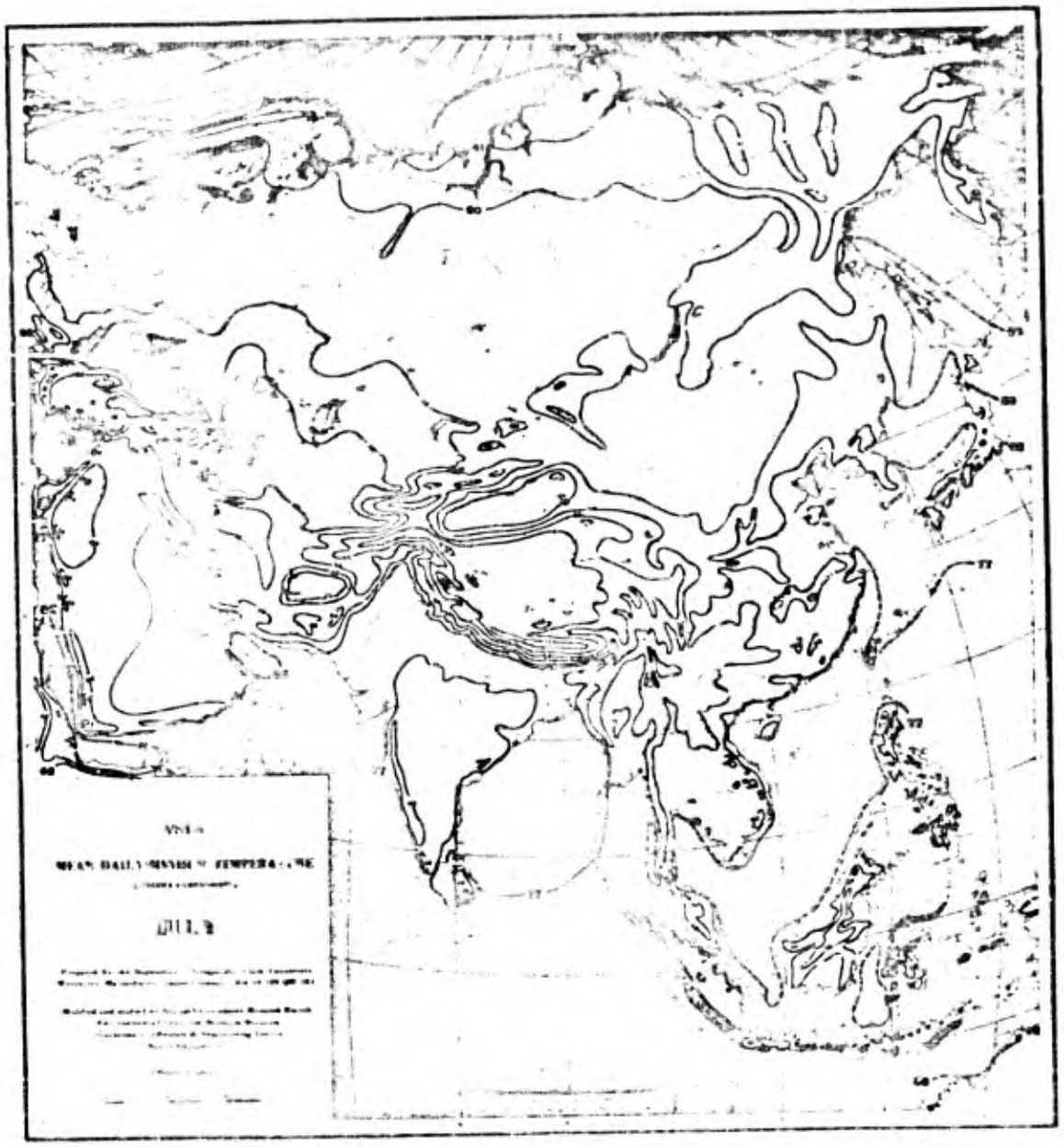


ASIA
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AUSTRALIA
MEAN DAILY MINIMUM TEMPERATURE
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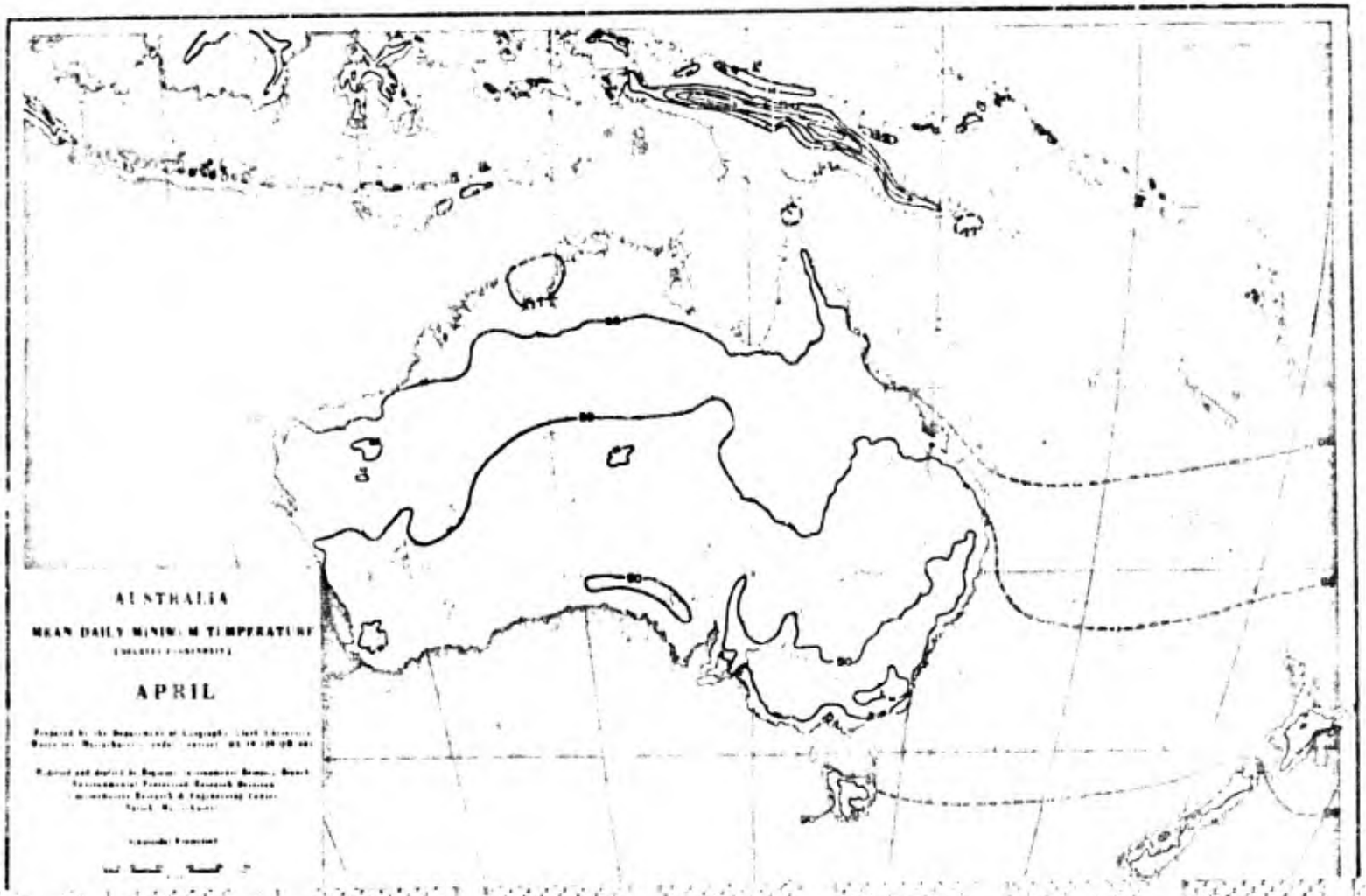
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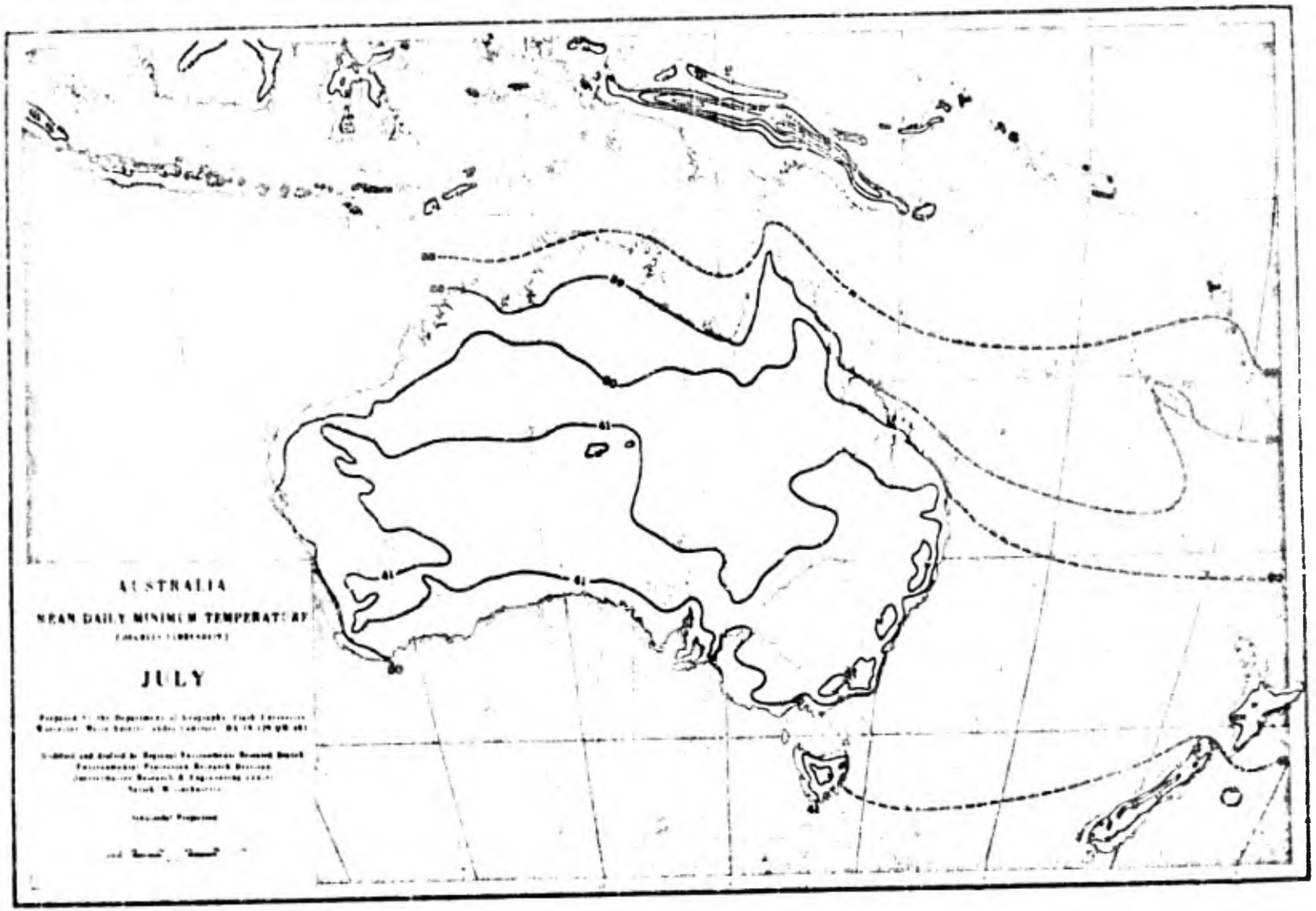
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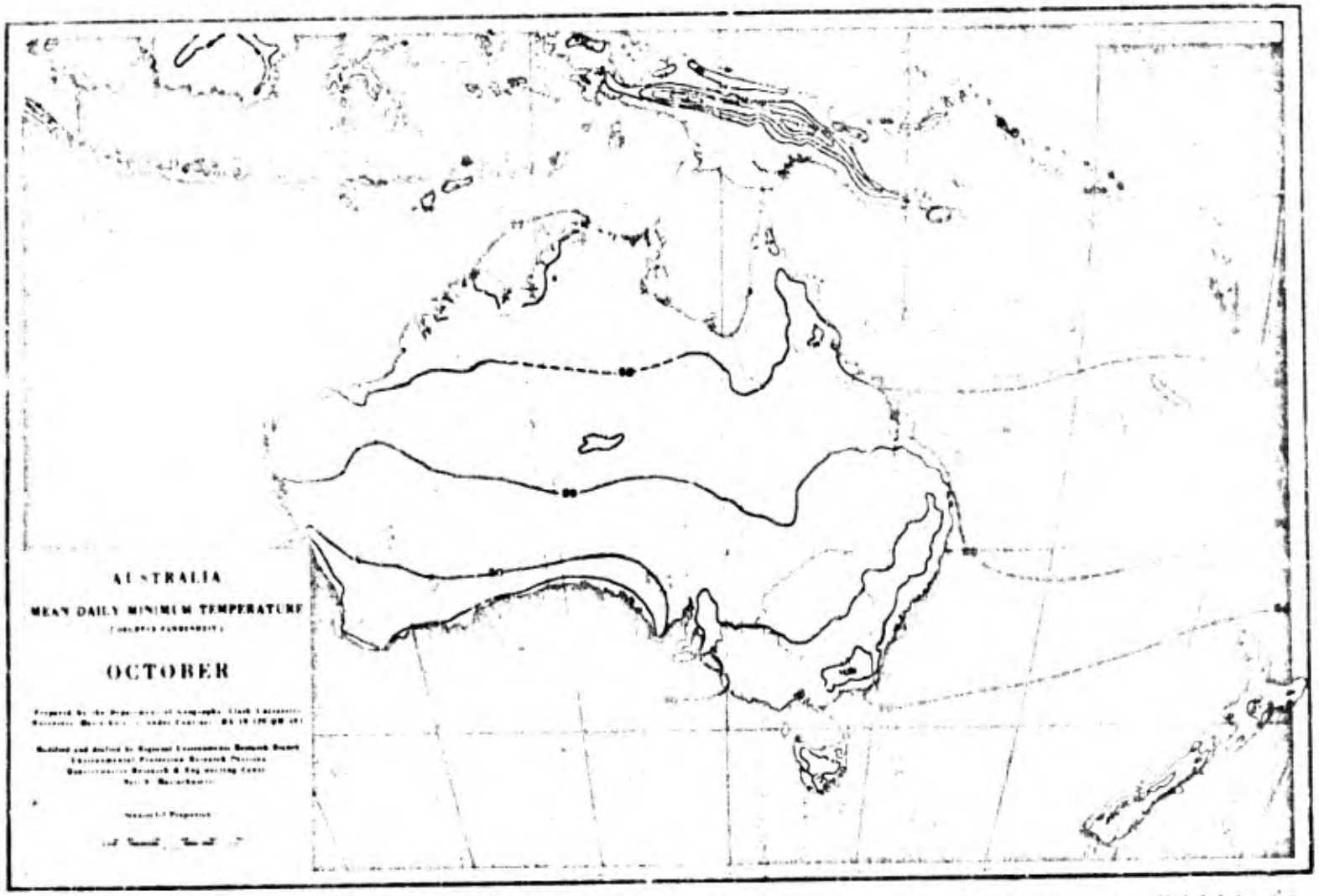
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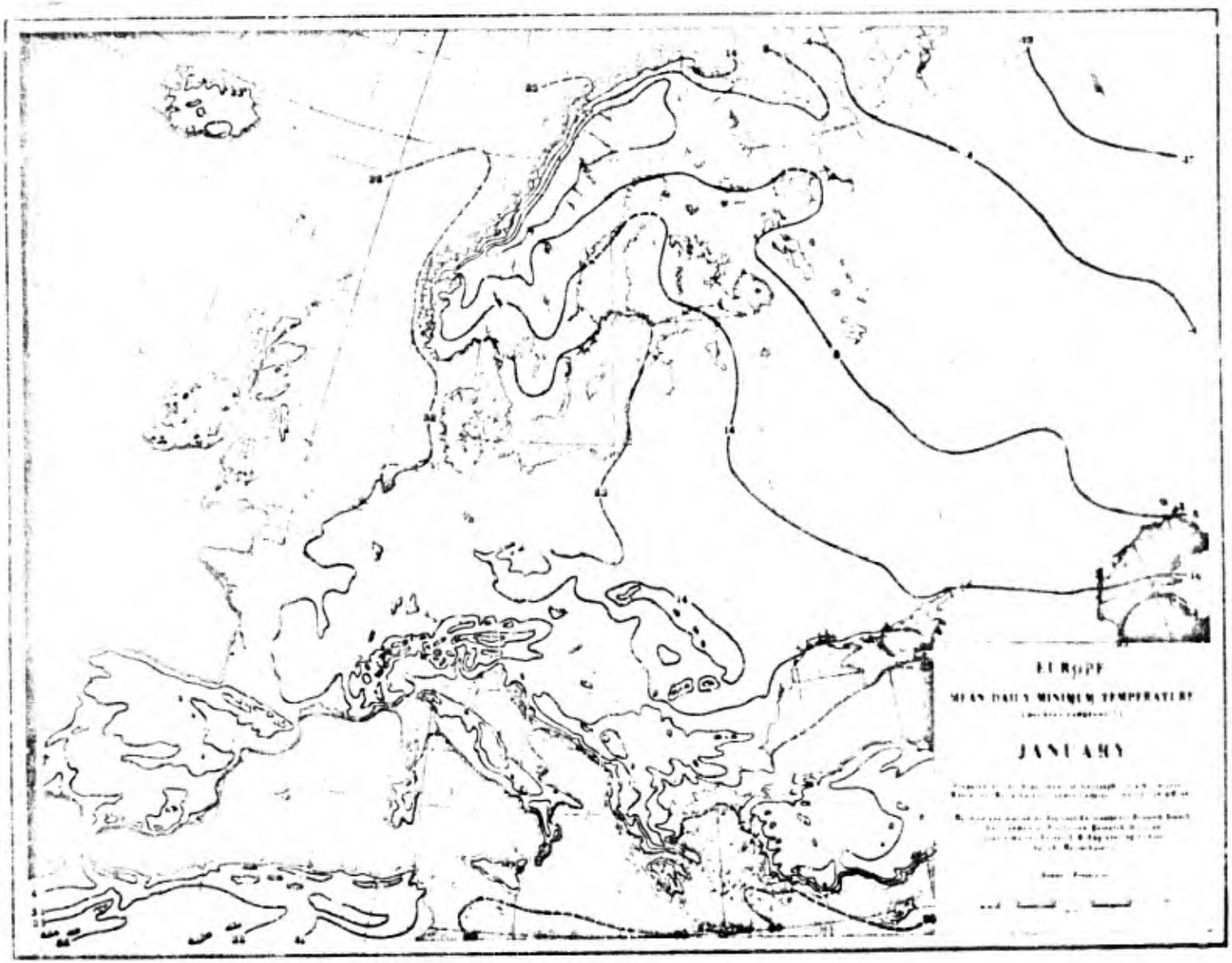
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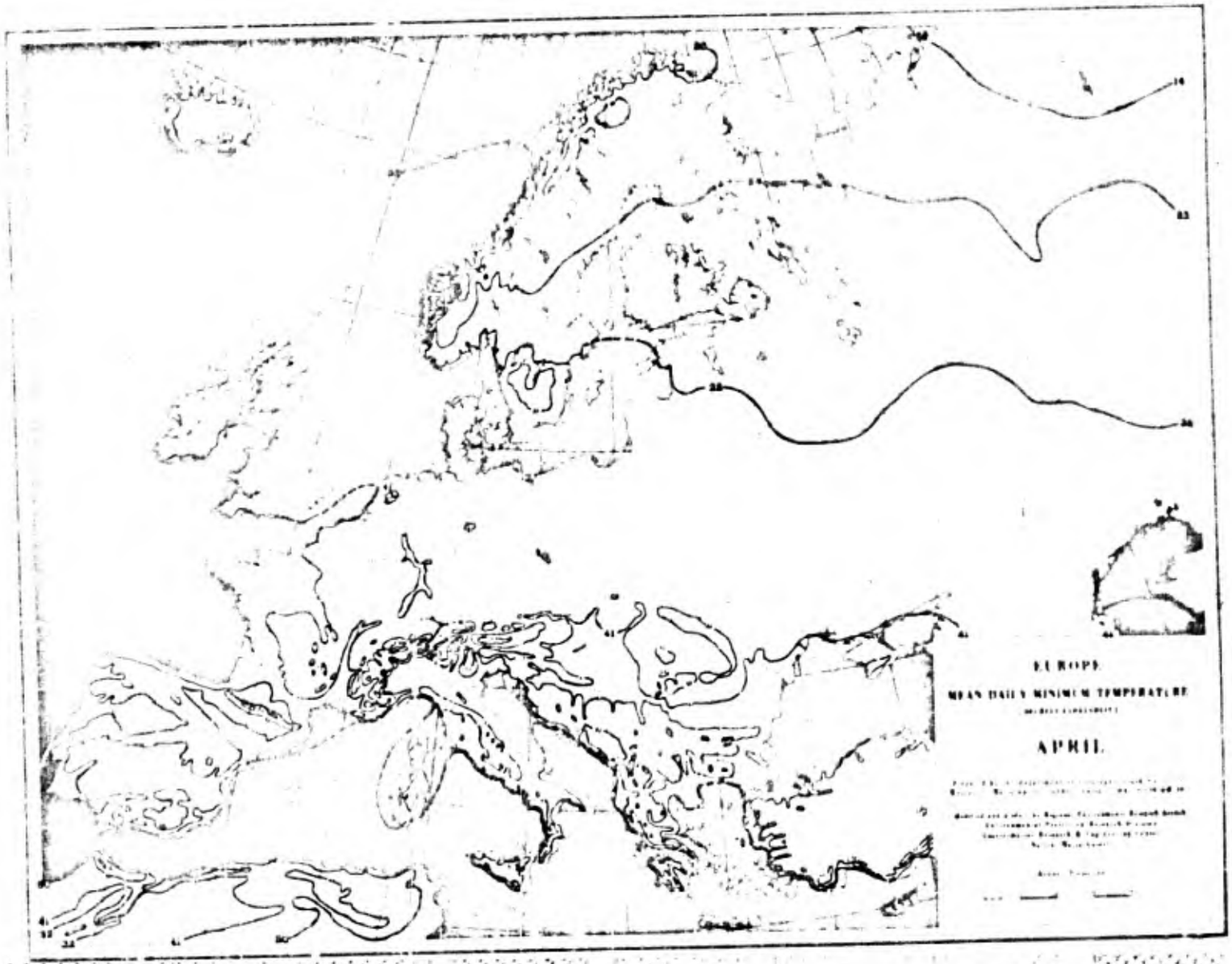
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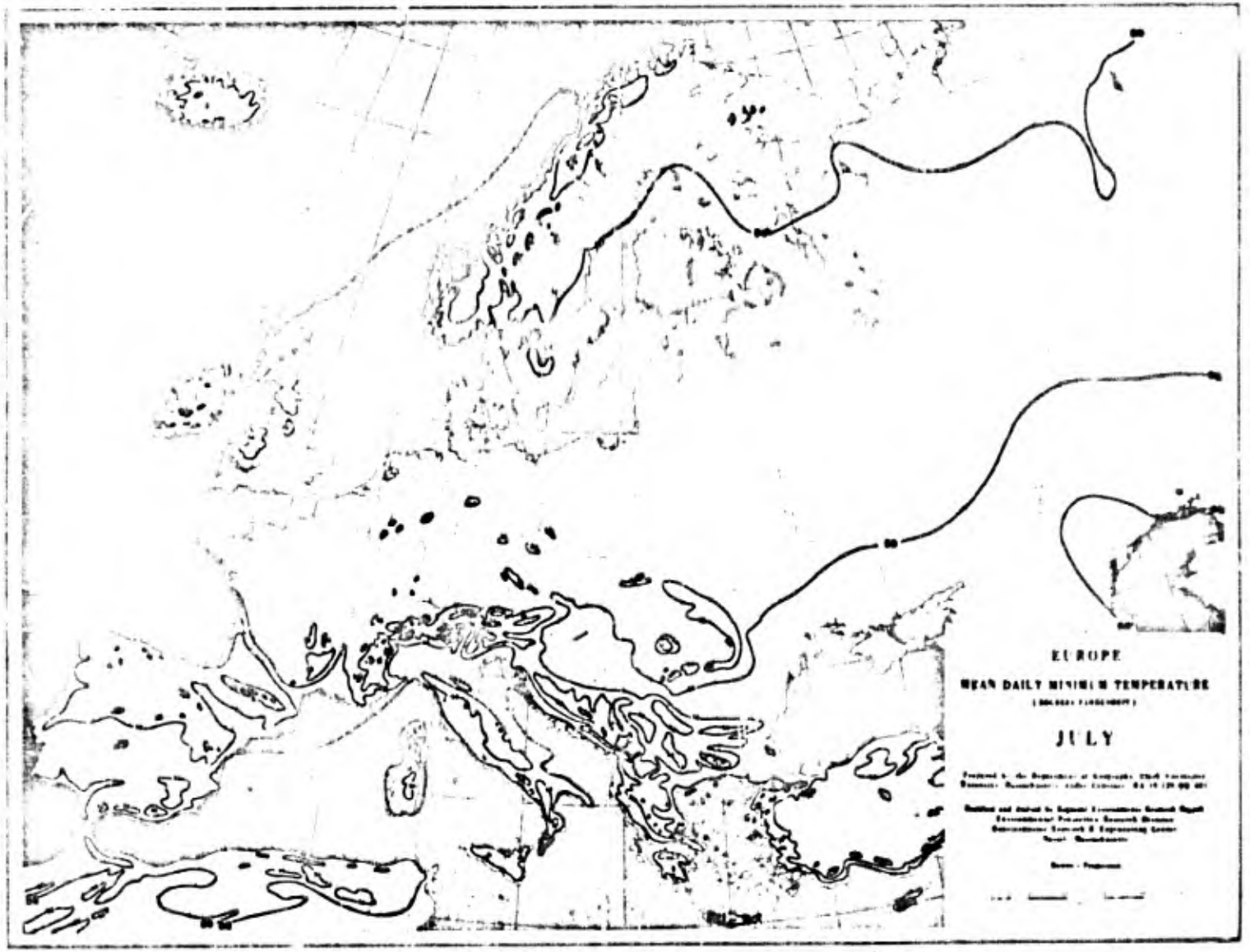
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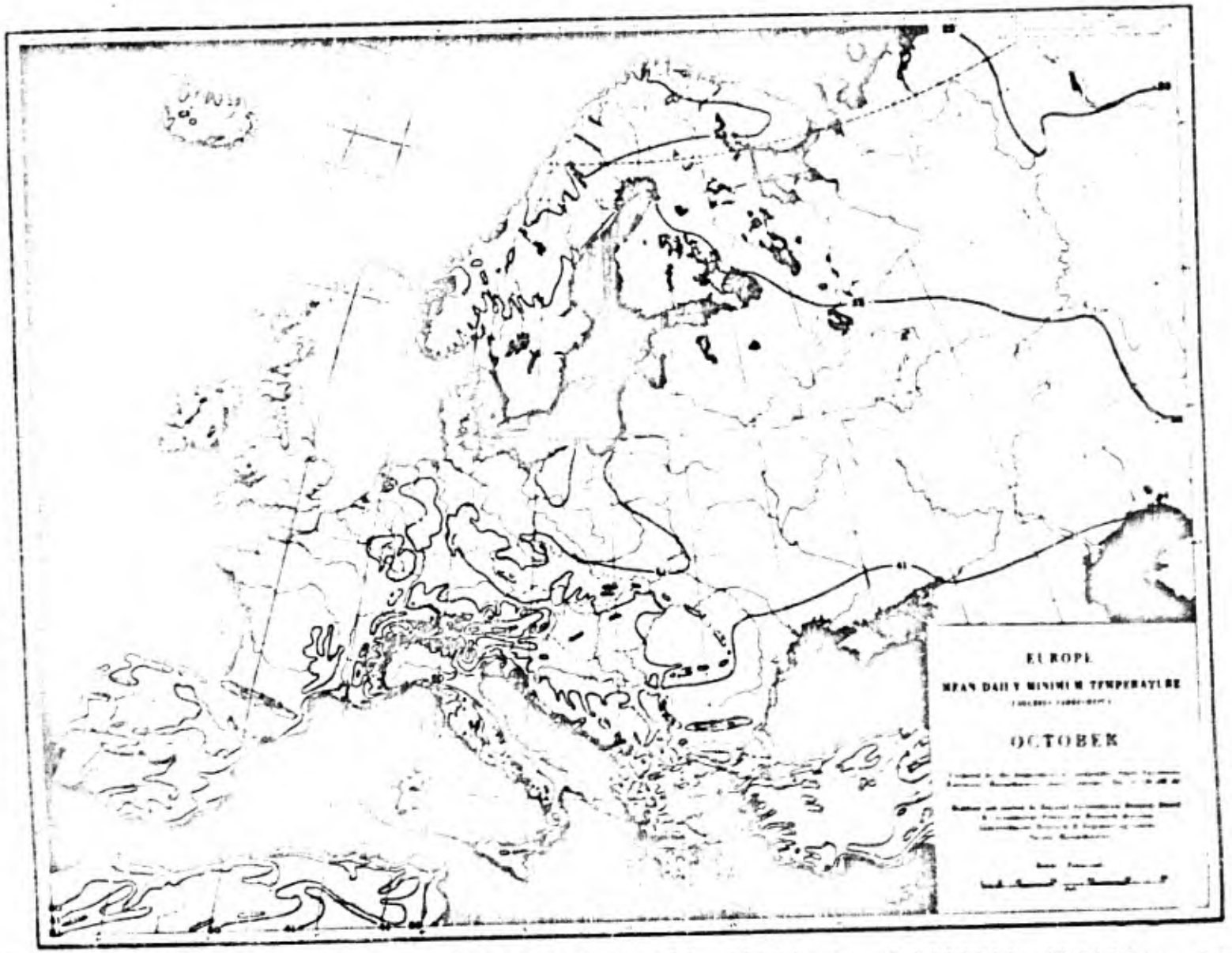
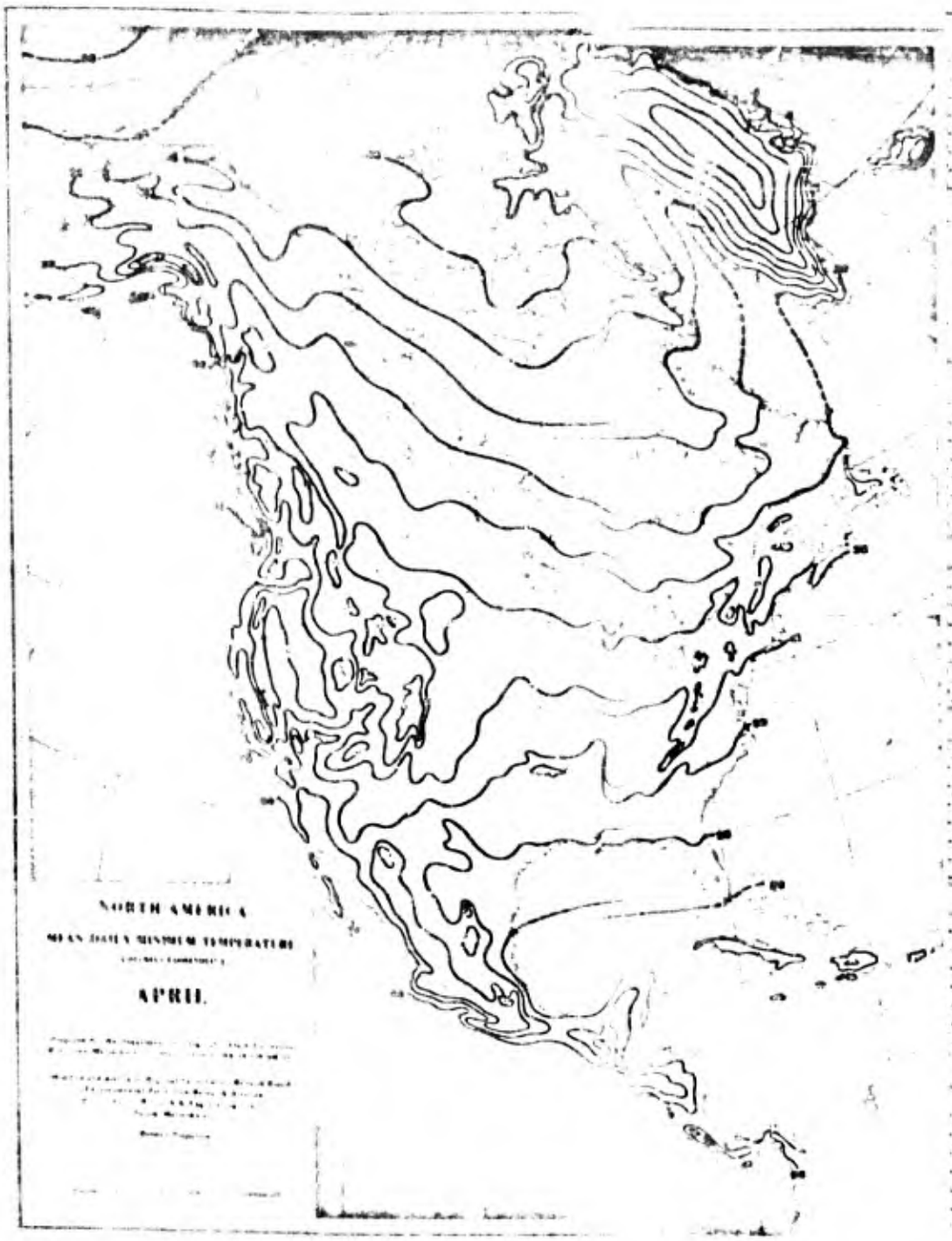

EUROPE
MEAN DAILY MINIMUM TEMPERATURE
OCTOBER


NORTH AMERICA
MEAN DAILY MINIMUM TEMPERATURE
JANUARY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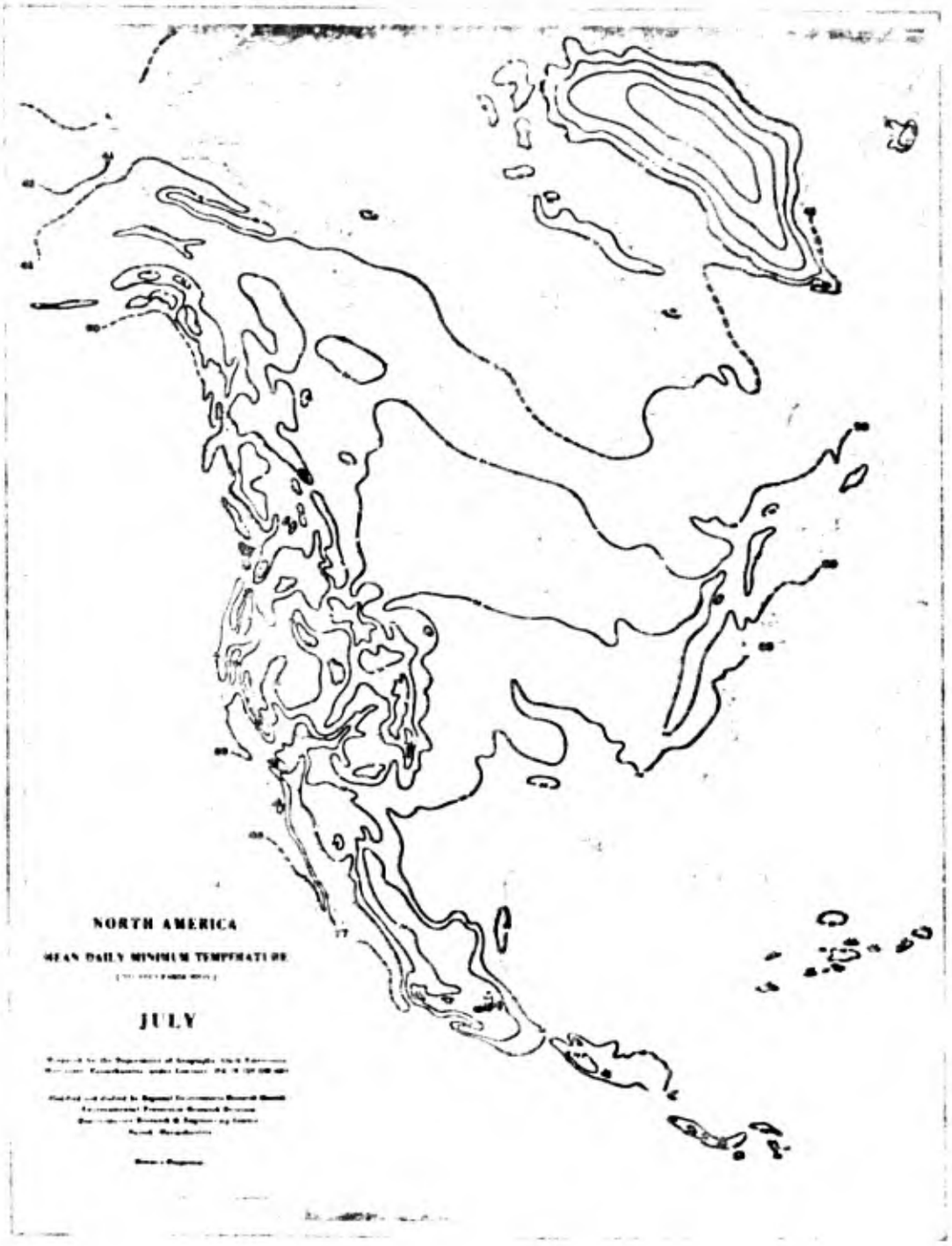
NORTH AMERICA
JULY


NORTH AMERICA
OCTOBER


SOUTH AMERICA
MEAN DAILY MINIMUM TEMPERATURE
JANUARY


SOUTH AMERICA
MEAN DAILY MINIMUM TEMPERATURE
APRIL


SOUTH AMERICA
JULY


SOUTH AMERICA
OCTOBER

## APPENDIX

### Sources and Related Studies

The basic data for the maps in this atlas were derived from a large variety of sources, including publications of the meteorological services of many countries. A few of the most widely used sources are mentioned here. The Naval Air Pilot Weather Summaries (Supplements "B"), published by the Hydrographic Office of the U.S. Navy Department, include mean daily minimum temperature data for a large number of stations. The U.S. Weather Bureau's Index of Climatic Data, a card file, includes otherwise inaccessible data for many stations. One of the most useful sources for worldwide mean daily minimum temperatures, though its publication in book form is not yet complete, is the British series, "Tables of Temperature, Relative Humidity and Precipitation for the World," M.O. 617 of the Meteorological Office, Air Ministry. The series as planned will include six volumes, of which four (North America, Africa, Asia, and Australasia) have been published to date. Station location maps are included in each volume, and all temperatures have been converted to degrees Fahrenheit.

Various maps have been published showing mean daily minimum isotherms. Except for comparative purposes, none of these maps were used in the present study because they cover limited areas, are based on old or inadequate data, or use a different interval between isotherms. Some of these series of maps are listed below:

Commonwealth of Australia, Bureau of Meteorology. Climatological Atlas of Australia. Melbourne, undated (probably about 1936). (Includes monthly maps of "normal daily minimum temperature," with isotherms at intervals of 5 F°.)

Kincer, Joseph B. Temperature, Sunshine, and Wind. In: Atlas of American Agriculture; O. E. Baker, ed., U.S. Dept. of Agriculture, Washington, 1928 and 1936. (Includes small-scale maps of continental United States, showing mean daily minimum isotherms by months, at intervals of 10 F°.)

Thomas, Morley K. Climatological Atlas of Canada. Meteorological Division, Dept. of Transport, Canada, and Division of Building Research, National Research Council, Canada. Ottawa, 1953. (Includes maps showing mean daily minimum isotherms for January and July, at intervals of 10 F°.)

U.S. Weather Bureau (Special Report No. 148) and U.S. Army Air Force, Directorate of Weather (Report No. 256). Mean Minimum Temperatures Throughout the World. Washington, Nov. 1942. (Includes monthly maps of world on 22- by 16-inch Mercator projection, with isotherms at 10 F° intervals; very generalized; also includes tables of mean daily and absolute maximum and minimum temperatures for 146 stations throughout the world but excluding continental United States.)

Visher, S. S. Climatic Atlas for the United States. Harvard Univ. Press, Cambridge, 1954. (Includes small-scale maps of United States showing "normal daily minimum temperature" for alternate weeks, with isotherms at intervals of 5 F°.)

Several reports published by the QM R&E Command have related mean daily minimum temperature to other measures of cold stress, particularly in North America. Research Study Report RER-15, "January Temperatures in North America as a Basis for Sleeping Bag Issue," compares mean daily minimum temperatures with other criteria for delimiting zones of issue of one type of equipment. Technical Report EP-6, "Frequencies of Selected Low Temperatures in Alaska," includes tables and maps showing frequencies (in percent) of daily minima below certain specified temperatures, and monthly maps of mean daily minimum temperature and other temperature characteristics with isotherms at intervals of 10 F°. In a series of studies now nearing completion, mean daily minimum temperature for the coldest month is one of the climatic elements used in delimiting worldwide areas having climatic analogy with certain Department of the Army test sites. The series includes: eight reports comparing desert climates with the climate of Yuma, Arizona; two reports comparing the climate of cold regions north of 45° N latitude with the climate of Fort Churchill, Canada, and Fort Greely, Alaska; and ten reports comparing tropical climates with the climate of the Canal Zone.

## Acknowledgments

The data on which the maps in this atlas are based were compiled and plotted by Messrs. Anthony Sas, John George, Frank Sparicio, and Simon Baker under the direction of Mr. Guy H. Burnham, Instructor of Cartography, Clark University. The maps were drafted in the Cartography Section, Regional Environments Research Branch, Quartermaster Research & Engineering Center, under the direction of Mr. Roland J. Prodigh. Cartographic drafting was performed by Miss Gertrude Barry, Mr. Andrew D. Hastings, Mr. Aubrey Greenwald, and Mr. William Loughlin. Mr. Hastings also made substantial contributions to the maps by adding new data for the polar regions and adjusting isotherms accordingly.

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ARLINGTON 12 VIRGINIA